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ABSTRACT

This speech, prepared for the SI Metric Conference "Metrication is Everybody's Business" held in Newark, Delaware, describes the extent to which the metric system (SI) has been adopted in Canada. The author provides examples of adoption of SI, mixture of SI with the English system, and areas where the English system is retained. He discusses briefly the role of the government and mentions instances of the role of the Canadian press in the Canadian conversion to the metric system. (SD)

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"My Mass is 20 kg": Aspects of Canadian and International Progress toward an SI Way of Life[1]

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An Address before the SI Metric Conference, "Metrication is Everybody's Business," Sponsored by the Delaware Department of Public Instruction and the University of Delaware, Delivered at John M. Clayton Hall, University of Delaware, Newark, 4 May 1976

by

Harold Don Allen

Nova Scotia Teachers College

Truro, Nova Scotia, Canada

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[1]Lest concepts be confused, the author hastens to point out that his mass (for better or worse) is of 100 kg order of magnitude. The quotation is his daughter's who (at age eight) has believed that mass is mass and SI is simple . . . which it is.

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What follows seeks to reflect the spirit and content of an informal luncheon address given on Tuesday, May 4th at the SI Metric Conference organized by the Department of Public Instruction, State of Delaware, and the University of Delaware, and held at John M. Clayton Hall, University of Delaware, Newark, Delaware. This text has been assembled, at the invitation of conference organizers, from speaker's notes. The hope and intention have been to capture the mood of the address and the occasion rather than to present a formal paper on the subject.

Don Allen

Truro, Nova Scotia, Canada,

10 May 1976.

"My Mass is 20 kg": Aspects of Canadian and International Progress toward an SI Way of Life[1]

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An Address before the SI Metric Conference, "Metrication is Everybody's Business" Sponsored by the Delaware Department of Public Instruction and the University of Delaware, Delivered at John M. Clayton Hall, University of Delaware, Newark, 4 May 1976

by

Harold Don Aller
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Ladies and gentlemen, good afternoon.

I am delighted to be with you in this glorious Spring weather and to be able to take in the wonderful colour of trees and flowering shrubs in Delaware this particular week. (When I left home, we'd 20 degree sunshine, but buds were barely opening on the trees.) I am equally delighted to be a part of, and to be able to make this contribution to, this exceptionally sound conference of educators and men of business and industry on SI metric and implications for metric education.

We Canadians (you'll not find this in print), despite our big, broad land, in such matters as numbers, know-how, material wealth, and

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[1]SI (Système International d'Unites) refers to the revised, international metric system of the 1960 General Conference on Weights and Measures, the coherent, absolute metric revision to which Canada, the United States--indeed, the world--currently are committed. SI must not be confused with CGS, MKS, MKSA, and other metric versions which many of us were taught in our initial training.

international "clout," tend on occasion to feelings of relative inferiority . . . when we compare ourselves with the neighbouring nation of Hollywood, Madison Avenue, and such, to the south. It's unconscious, but it's real. It struck me, in new perspective, in my Air Canada DC9, five kilometres and more above Kennedy International Airport, the other--very rainy--New York evening. In terms of metric know-how--or, really, anything else--what could I possibly tell you? Then I figured, any country that can build that jet, then keep an 850 km/h plane circling (in holding pattern) for forty minutes in peasoup cloud . . . can't have all the answers. I'm glad to be down on the ground, intact, and able to share with you international perspective on SI conversion to date.

Canada opted opted for SI in January of 1970, a non-event in the eyes of news editors of the period but a major step in our perspective as nation and world trader. The government decision--to commit the nation to eventual conversion to the modern, international version of the metric system, SI--was announced in Parliament . . . on the floor of the House of Commons. The announcement provoked little or no controversy: indeed, it had the vocal support of all parties. Canada's commitment was, in one sense, a beginning (of a period of

orderly conversion in all sectors), but metric units had been on Canadian law books (if not in homes and businesses) since 1873. In another sense, Canadian commitment marked a culmination, for other traditionally British nations (United Kingdom, Republic of South Africa, Ireland, Australia, and New Zealand) already had started the process of SI conversion. As of January 1970, only two major nations had failed to plan commercial adoption of metric measures. With Canada's announced commitment, only one remained.

Canada, as governments will, created a number of special bodies to oversee her change to SI. One was the Metric Commission, charged with coordinating and obtaining voluntary consensus in the overall process of conversion. Metric Commissioners were appointed, broadly representative of Canadian geographical regions and of various walks of life. I know of no lobbying for appointments (such as, we all realize, currently is going on in the United States). I know no one who knew much about the Metric Commission until it was a fait accompli. A second body was the Standards Council of Canada, one of whose responsibilities was to provide the specifications for a Canadian metric, reflecting SI. A further office, of perhaps dispro-

portionate significance to us as educators, was and is a Government Specifications Board, with services optionally available (at cost) for screening materials for correctness of Canadian metric practice . . . and, in effect, a metric seal of approval. Note that Canada's metric conversion, like Britain's and Australia's and, in a sense, unlike South Africa's,[2] has been "voluntary"--an attractive word, but one with two-fold implication: that, in a sense, you don't have to do it if you can't be convinced to; and that the government is not about to foot the bill.

After six years and more, where are we in Canada in this process of "orderly metric conversion"? Let me illustrate, in terms of specifics. Ten or so illustrations should suffice.

1. Last week, three of my graduating students and I responded to an unusual distress call from the community radio station. We found ourselves for an hour and a half with felt pens, masking tape, and clear plastic, draped over a somewhat disconcerted disc jockey.

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[2]According to our good friend Andre Nadash, articulate American observer of Republic of South Africa conversion, the process has been voluntary, successfully so, to a considerable extent. Only when a particular aspect of conversion approached completion has legislation--rather formidable legislation--been introduced to finish the task.

When we had finished, direct-reading instruments on the station console had taken on a new look. Atmospheric pressure read kilopascals; wind velocity, kilometres per hour, in keeping with preferred Canadian practice since April 1st.

2. They've installed a new heating system in the church. Degrees Celsius are the calibrations on the thermostat in the church parlour, my wife informs me. Outdoor readings have been in Celsius for fourteen months now, of course. At this point, when a Canadian says degrees, more than likely the reference (though not necessary stated) is to the Celsius scale.

3. Rain falls in millimetres, snow in centimetres, each a reflection on sensible precision in measurement. All precipitation has been reported in metric units since September 1975.

4. Railroad and bus timetables now routinely list distances in kilometres (to 0.1 km) and miles. Times are given with reference to the 24-hour clock. Topographic maps have square kilometre grids, but the contour interval (pending resurveying) likely still is in feet.

5. Ice cream sells by the litre, at least in our town. In something close to payola, mathematics education students were presented by the local dairy with the first 2 litre buckets of Nova Scotia

ice cream, and unhesitantly dived in (for press photographers). Pints, quarts, and half gallons, we realized (almost with surprise) never again will be sold.

6. Sugar now sells--routinely--in 500 g, 1 kg, and 2 kg boxes or sacks. New packages so resemble their former counterparts that many, no doubt, fail to realize they're buying "metric." Flour sells in 10 kg bags.

7. Tooth paste comes, in general, in four sizes, an eloquent instance of "rational" metric conversion--25 ml, 50 ml, 100 ml, and 150 ml. A fifth size, 75 ml, occasionally is seen. Five sizes serve to replace the multiplicity of twenty-nine sizes which Canadians knew in relatively recent times.

8. Lumber 50 mm by 100 mm will replace (but little differ from) the now familiar "two by four," but plywood panels, at this point, have very little changed. Eight feet by four feet by <u>six millimetres</u> is the strange hybrid currently on sale.

9. Our youngest, on arrival, registered at 4.6 kg (4600 g) birth mass and a 50-odd centimetre length. And that's what appeared in the birth announcement. "My, that must be a small baby," a

neighbour observed. "Is she all right?" For the record, 4.6 kg is not a small baby. Medical records are being kept, increasingly, in metric units. All data fed to our hospital computer, for example, is metric. Also, Celsius clinical thermometers are generally on sale.

10. A conversion phenomenon which may be distinctly American is to have grown men argue--even jeopardize friendships--over the distinction between mass and weight. Mass (in kilograms) and force (in newtons) are clearly distinguished in SI--but pound could have meant either or both. Mass commonly is determined by weighing (measurement by analogy), much as temperature is determined by mercury column length, but mass is not weight. A year or more ago, our eight-year-old daughter came home from a metric activity day and set matters straight, stating (impeccably), "My mass is 20 kg." No one had told her it was hard. It isn't, so I hope no one ever does.

You have invited me to provide a critical overview of Canadian metric developments to date. This I shall do, and I hope I can serve as a catalyst in your deliberations. Let me, at the outset, indicate my role in Canadian metric activities. I've had

no official position, and this has had tremendous advantages. I've been able to call the shots as I saw best. I was, and am, a teacher educator, preparing young people to teach in elementary classrooms of one province, Nova Scotia. It was apparent to me, and I'm sure to others, that national commitment to SI metric had long-term curricular implications, far broader and more far reaching than might at first be apparent. I had no desire to turn out, as teachers, young people with built-in obsolescence. Accordingly, I started (as you very well may have to) with myself. I sought out and mastered SI, the metric of 1960, setting aside the CGS of my high school science and the MKS and MKSA learned 25 years ago in the Macdonald Physics Building at McGill. (Erg, dyne, and calorie are not SI, and neither is gram- or kilogram-force.) I duly digested Canada's White Paper on Metric Conversion, and South African, Australian, and other source materials on SI changeover. One fact hit home, hard. Metric, today (and, even more so, tomorrow) is SI, and metric is decimal. That, in fact, is what it's all about. At that point, I was ready, with my students, to consider the real world, and to look to the significance of decimal, SI-metric for evolving patterns in Canadian life. I turned out my first metric

class in 1973. They had, of course, dual capability. But I strongly suspected they would teach decimal and SI whenever opportunity afforded. They were part of the solution, rather than part of the problem, in an emerging metric nation.

Canada's Metric Commission, predictably, has evolved a sizable secretariat. In its central task of coordinating conversion, the Commission has had associated with it an imposing structure of steering and sector committees representative of Canadians in many walks of life. There is much here that could be copied with profit. A fundamental weakness, as I see it, however, has been an unduly high turnover in Metric Commission staff. Some of this has resulted from use of Metric Commission experience as a civil service stepping stone. Continuity would seem highly desirable in a core of key personnel associated with such a longer-term venture as a nation's SI conversion.

Strong leadership and a sense of national commitment to SI metric would seem (for optimal conversion) essential from the start. This Canada has lacked, I feel. Quietly, efficiently, things have been happening, but the public has been largely in the dark. I sense an attitude of "they'll be told what they need to know when they need to know." No opposition political party has in any way

opposed SI conversion as such, although (predictably) each has attacked, with eloquence, the manner in which it is being done. (At the heart of the problem is voluntarism--which few openly oppose--and the companion question of who pays the shot. Ottawa's invariable answer is that costs--and benefits--in general will "lie where they fall.") Little political "mileage" is to be gained from metric conversion (as some unconverted soul put it)--and a strong rallying call, at federal or provincial level, has yet to be heard. At federal level, government departments and agencies have been uneven in their commitment to--or awareness of--SI conversion. A powerful SI leverage will exist when government itself is truly committed, and when contracts, specifications, and such, reflect preferred metric practices.

Consumer goods now appear on shelves with, in general, dual labelling, traditional units and something approaching SI. Packaging legislation requires such dual labelling, except in instances where goods come in rationalized metric sizes. In the latter instance, SI will suffice. Hence, two litres of ice cream (that and nothing else). However (incredibly) packaging legislation was put through before Standards Council recommendations were generally available. Everyone

did his thing, metrically speaking, and for a time confusion in spelling and symbolism was as bad as it now is on American shelves. Dual labelling, psychologically, is virtually useless, of course. It produces a degree of awareness (which is good), and considerable irritation. Coupled with "soft" conversion, where old packages are relabelled in metric measures, awkwardness results, and metric looks anything but an improvement. A pound of chocolates becomes 453.6 grams (to improbable precision), a Canadian [Imperial] quart of milk, 1.14 litres; a four-inch paintbrush, 101.6 millimetres.

Canada's SI commitment reflects, in the main, real-world realities of a shrinking planet and of vigorous participation in international trade. The additional realities of an absolute, coherent, decimal measurement system are of strongest appeal to Canada's teachers, although science and technology, too, have much to gain.[3] Education in Canada is a jealously guarded area of provincial autonomy. Canada lacks even a federal office of education. Accordingly, each of ten provinces has considered implications of SI conversion for

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[3]And have far to go. Read the metric in a typical issue of Scientific American and witness each sector talking its own non-SI metric jargon. Tower of Babel or medieval marketplace, it reflects the state of North American measurement science in the 1970s.

school curricula.[4] Four provinces, to my knowledge, have worked diligently and have made significant contributions to educational thinking on SI: Manitoba, Ontario, Quebec and Alberta. Canada's highly competitive textbook publishing industry recognized SI commitment as a major challenge, and in elementary school mathematics programs no one fell for the "dual" trap. Every series currently being marketed (to my best knowledge) is "SI only." The total program may not be as decimal as it should be and in future versions will be, but measurement is metric and spelling and symbolism conform to SI. Learning aids are another matter, many being United Kingdom and United States imports and frequently riddled with errors. However, the situation has improved enormously in the last two to three years. Our supply companies have met up with consumerism at its finest. If it's not correct SI, it simply won't sell.

A "stylized M" (suggesting a maple leaf) has become the symbol of SI conversion in Canada. (Each other converting nation has, I believe, found significant uses for a similar logotype.) Canada's

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[4]However, a Council of Ministers of Education for Canada has produced superb pedagogical guidelines.

M appears on a package to point up hard conversion: you buy flour, sugar, or whatever, in a rational metric size. The M, too, may appear on a school text or a learning aid . . . but only with permission, for the symbol is Metric Commission property. Permission is freely given once a product passes screening by the Government Specifications Board. Everything is quite voluntary, of course, but M on an educational product is a strong selling point. Enough said.

"Metric is decimal. That's what it's all about." No one questions that statement, but it takes time to appreciate all it really says. You don't think "one-third of a metre." You don't. Thirty-three centimetres or 333 millimetres, whatever precision is appropriate, but decimal units throughout. We so naturally halve and quarter. Your quarter dollar (20 cents would be preferable) is a leftover (two bits) from days when the dollar was the Spanish "piece of eight" (8 reale piece). If measurement is decimal, what is the continuing role for non-decimal fractions? A very limited one, I believe. Ratios and proportions will retain significance, of

course, as in laws of chemical composition. (But measuring out will be in grams or millilitres, to appropriate precision.) As to other uses, I have strong feelings on that subject. As a textbook author,[5] I was left (for my sins) to fill several pages with real-world problems on non-decimal fractions. After you've done the obvious with a pizza, what's for an encore? I'll tell you. I cheated. "Three-sevenths of a week and four-sevenths of a week" . . . "three-fourths of an hour plus one-half of an hour." I am well aware, of course, that the algebra of junior high school presupposes familiarity with the system of rational numbers. This does not alter my view. Division of $2\frac{3}{4}$ by $3\frac{4}{7}$ still has to be defended as elementary school subject matter when the equation $ax + b = c$ (a, b, and c integers or rationals, a non-zero) can be effectively "cleared of fractions" by multiplying by any common denominator.

If the continuing role of non-decimal fractions has received little attention (textbook publishers, alas, in the main produce what the market is prepared to buy), the questions of significant figures

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[5] Sidney A. Lindstedt, Harold Don Allen, and Iris Schickler, Mathematics with Metric Measure, I-VI, based upon Silver Burdett Mathematics System (Agincourt, Ontario: General Learning Press, 1974-75).

and approximate computation have been wholly untreated in elementary texts. This cannot go on. People think metric is hard and decimal is hard because for too long they have been working with ridiculous decimal places. Measure your height. To the centimetre. Not to the "half centimetre," whatever that is. Not to the millimetre . . . you sag at least that much during a normal work day. Canadian quart milk cartons (Imperial measure) are meticulously labelled "1.14 litres." That sounds reasonable, sensible. Yet I'm told within the dairy industry that filling machines operate with a tolerance of up to three per cent. "An aquarium is 42 cm long, 28 cm wide, 20 cm high, to the centimetre. Find its capacity, in litres, and justify every decimal place." My students find that difficult, incredibly difficult. Yet it's something that we really must teach.

For you, as for me, teaching and working with and in SI involves two phases. One must learn SI, and learn it cold. Then one must relate SI and its properly associated unit to measurement activities in the real world. Distance, for most practical purposes, is measured in four units: between towns, in kilometres; in schoolyards, metres; body measurements and clothing sizes, centimetres; and shopwork

and such, millimetres. Decimetres, hectometres, and such, are primarily textbook units, and I'd have to be convinced of their place in a future Canada. The mass of a chocolate bar is grams; of a pumpkin, kilograms; and of a carload lot, metric tons (tonnes); no inbetween units have relevance. A soft drink can, in Canada, is 300 millilitres; an ice cream container, 2 litres; centilitre, hectolitre, and such will not enter normal vocabulary. The hectare will: think of the square on the length of a 100 metre dash. So will the kilowatt or megawatt (replacing horsepower), the kilojoule or megajoule (replacing calories or BTU's), the newton (for force), and the kilopascal or megapascal (replacing our remarkably diverse units for pressure). I'd teach the structure of metric units (atto- to exa-), of course, but I'd stress the metric about to find use in the real world.

I emphasize that introduction of SI metric in a non-metric, non-decimal environment is a continuing challenge, and anything but a one-shot affair. A colleague tells of meeting an old school inspector who reported that he was coming from a meeting organizing in-service workshops. Thinking of me, my colleague asked, "Metric,

isn't it? That's what everybody's doing." "Why no," responded the inspector, "we did that last year." Not really, and there is a point there. Also, because of research and writing commitments, my personal SI crusade unnecessarily slackened for some months, and I witnessed around me a conspicuous backsliding.[6] No, this is worth doing and doing well . . . metrically, as otherwise, Rome was not built in a day.

For us, as for you, conversion goes on . . . guided by (in your apt phrase) the "rule of reason." I once was asked what would happen to our railroad tracks (Truro is a railroading town). Not much, as you can well guess. Four feet, eight and one-half inches (our standard guage and yours) would, at some appropriate point, be soft-converted to 1.4351 metres (to whatever precision is deemed appropriate in laying track). It's the same guage, of course, and it's older than feet and inches. Early this century, during excavations of the ruins of Pompeii, ruts from Roman chariots were found preserved in Pompeii streets. The guage? Four feet, eight and

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[6] To the point where phys ed students, potential pathfinders in good, practical metric, were indulging themselves in a three-mile walkathon!

one-half inches, then as now a sensible distance between wheels.

You who are teachers now have the challenge of going out and introducing SI thinking in your schools and communities. My best wishes. You may find you have unexpected allies in the students themselves. Introducing a better system in the world they are about to inherit has appeal as a student "cause."

Of SI conversion, let me say this. The job will expand to fill the time available . . . and to take the money available. You can drag it on into the twenty-first century. The ultimate outcome, however, is unambiguously clear. Conversion needn't be protracted, and it needn't be expensive. Seeking an optimal course is your current national goal, and I wish you well. You may learn from us; and before this is over, we'll be learning from you. An optimal change will be easier on people, and easier on pocketbooks, so energy devoted to planning and coordination will be well expended. Let people know what is happening. Input--informed input--is essential at this stage.

In September 1977, Canadian highways in all provinces will be posted in kilometres. Speeds will be in kilometres per hour. Come up

and try our 20 degree summers, our millimetres of rain, our centimetres of snow. Listen to Olympic results from Montreal, I hope in honest SI. It'll be quite an adventure. Please call upon me if I can further assist you in any way.